500.37149X00

#### IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): S. MAEDA, et al

Serial No.:

09/294,137

Filed:

April 20, 1999

For:

DEFECT INSPECTION METHOD AND APPARATUS

Group:

Examiner:

#### TRANSMITTAL OF FORMAL DRAWING(S)

Assistant Commissioner for Patents Washington, D.C. 20231

June 24, 1999

sir:

Enclosed are thirty-nine (39) sheets of formal drawing(s), showing Figs. 1-12, 13A-13C, 14A-14B, 15A-15B, 16A-16B, 17A-17B, 18A-18B, 19-39, 40A-40B, 41-42, 43A-43B, 44A-44C and 45-46, in connection with the above-identified application.

Respectfully submitted,

Melvin Kraus

Registration No. 22,466

ANTONELLI, TERRY, STOUT & KRAUS, LLP

MK/cee Attachments (703) 312-6600

APPROVED	O.Ģ.	FIG.
BY **	CLASS	SUBCLASS
DRAFTSMAN		

FIG. 1

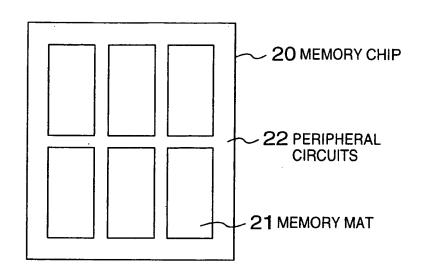
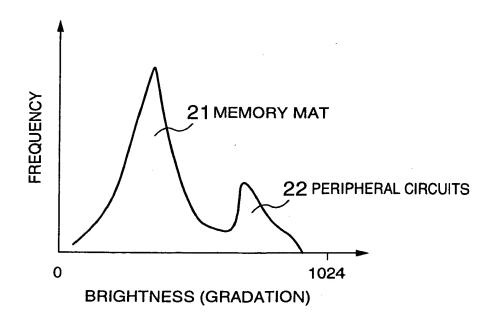


FIG. 2



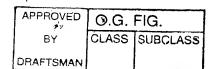
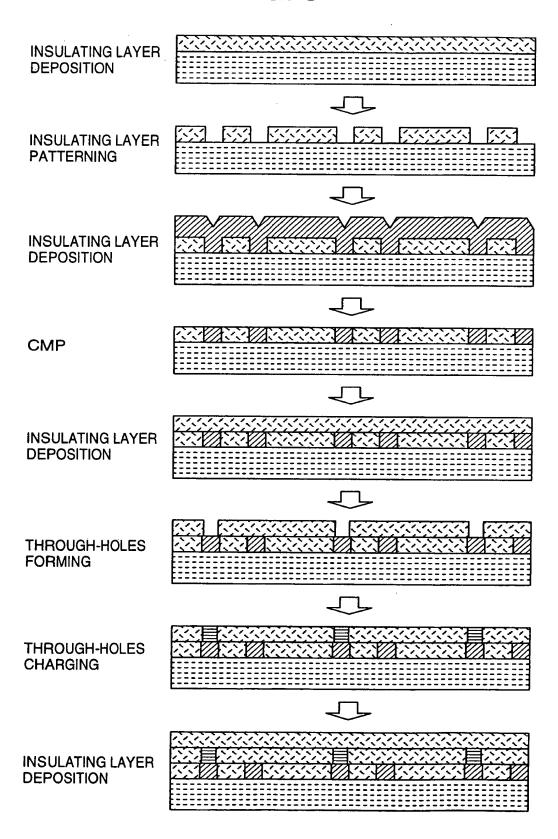
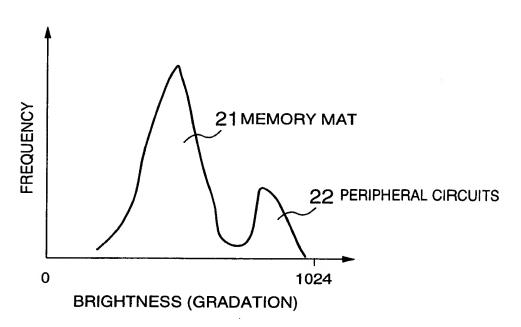


FIG. 3



APPROVED	0.G.	FIG.
BY	CLASS	SUBCLASS
DRAFTSMAN		

FIG. 4



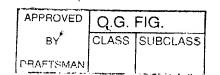


FIG. 5

		0	1
-1	8.28×10 <sup>11</sup>	1.56×10 <sup>11</sup>	9.07×10 <sup>11</sup>
0	8.55×10 <sup>11</sup>	0	8.59×10 <sup>11</sup>
1	9.0×10 <sup>11</sup>	1.55×10 <sup>11</sup>	8.33×10 <sup>11</sup>

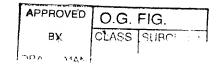
FIG. 6

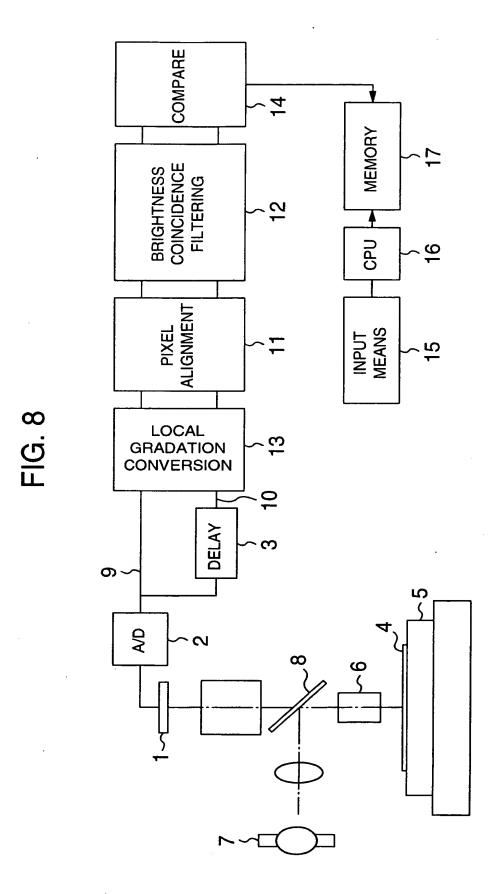
	-1	0	1
<b>-1</b>	967323	742941	951727
0	953922	732608	939418
1	950797	728523	937704

APPROVED	O.G.	FIG.
BY	CLASS	SUBCLASS
DRAFTSMAN		

COMPARE MEMORY LOCAL GRADATION CONVERSION 3 CPU 16 BRIGHTNESS COINCIDENCE FILTERING INPUT MEANS 5 PIXEL ALIGNMENT DELAY က **σ 5** δ ω) 9

FIG. 7





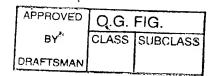


FIG. 9

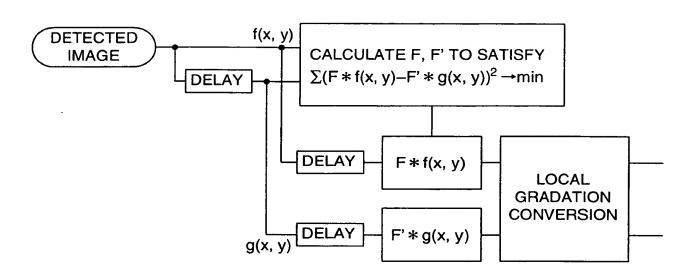


FIG. 10

$$F = \begin{bmatrix} 1 - \alpha - \beta & \alpha \\ \beta & 0 \end{bmatrix}$$

$$F' = \begin{bmatrix} 0 & \beta \\ \alpha & 1-\alpha-\beta \end{bmatrix}$$

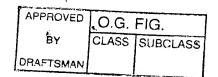


FIG. 11

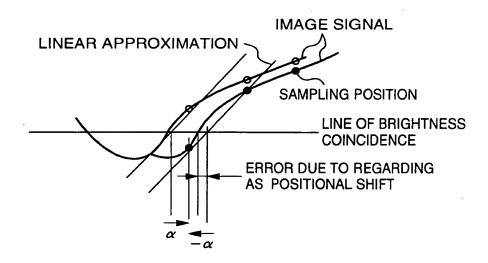
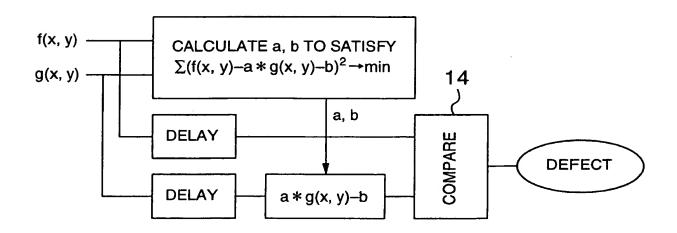
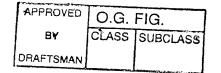


FIG. 12





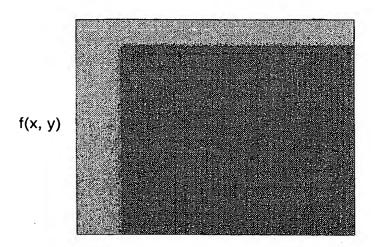


FIG. 13A

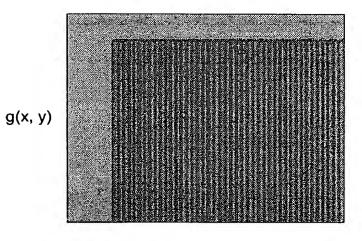


FIG. 13B

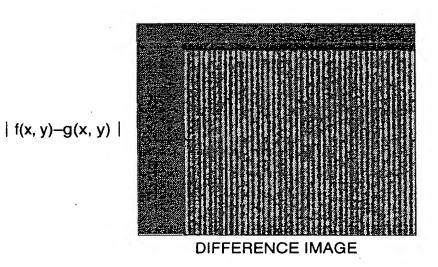


FIG. 13C

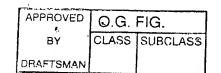
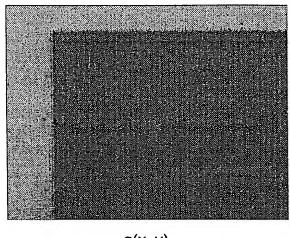
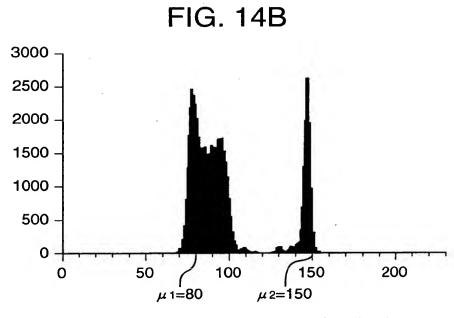


FIG. 14A



g(x, y)



BRIGHTNESS HISTOGRAM OF g(x, y)

APPROVED O.G. FIG.
BY CLASS SUBCLASS
DRAFTSMAN

FIG. 15A

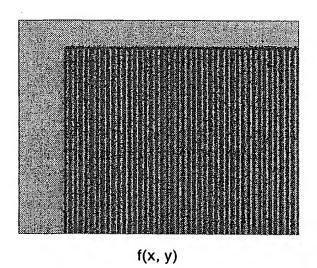
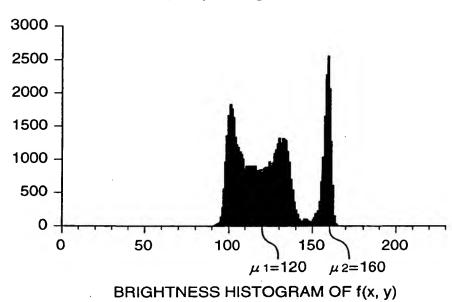
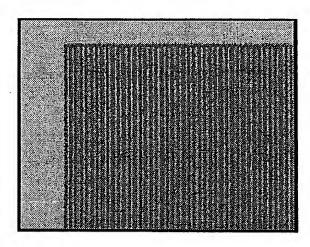


FIG. 15B



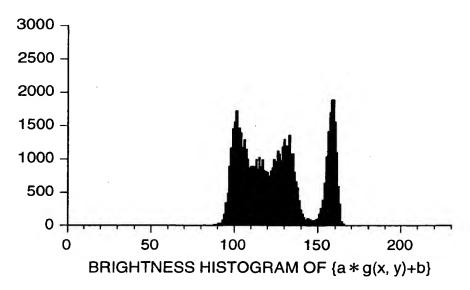
APPROVED	O.G.	FIG.
BY	CLASS	SUBCLASS
DRAFTSMAN		C. A. C.

FIG. 16A



a \* g(x, y)+b

FIG. 16B



\* a,b ARE ESTIMATED WITHIN LOCAL REGION OF IMAGE AT EACH POINT

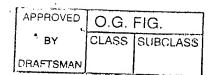
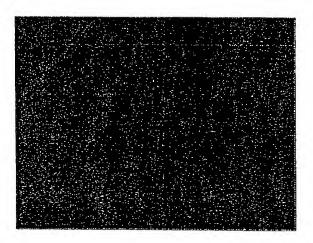
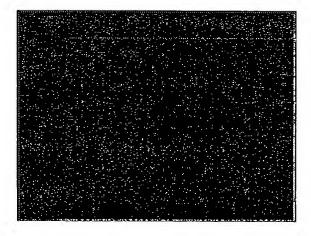


FIG. 17A



DIFFERENCE IMAGE 1 (3×3)

FIG. 17B



DIFFERENCE IMAGE 2 (5×5)

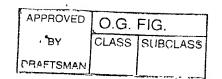
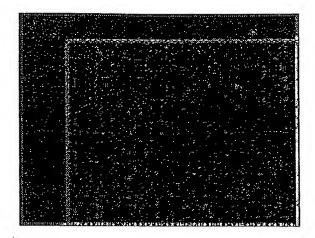
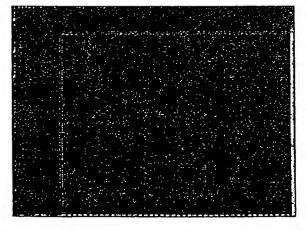


FIG. 18A



DIFFERENCE IMAGE 3 (7×7)

FIG. 18B



DIFFERENCE IMAGE 4 (7×7, WEIGHTED)

APPROVED O.G. FIG. BY DRAFTSMAN

COEFFICIENTS CI~CB: WITH CODE OFFSET K (FOR CHANGE OF SENSITIVITY) BRIGHTNESS AVERAGE OF NEIGHBORING PIXELS LOCAL CONTRAST **BRIGHTNESS OF AIMED PIXEL** EDGE INTENSITY ပ္ပ င် ၖ ပ FIG. 19 DETECT MAXIMU LOCAL MAXIMUM-LOCAL MINIMUM DIFFERENTIATE WITH RESPECT TO x DIFFERENTIATE WITH RESPECT TO y **AVERAGE** MOVING

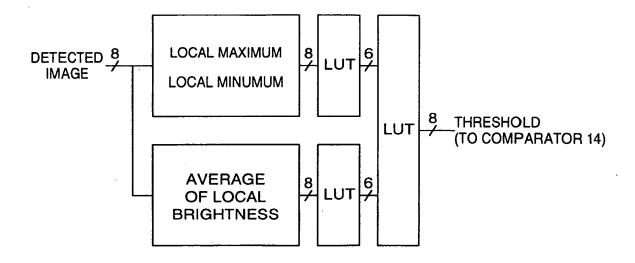
DETECTED IMAGE **▼ THRESHOLD** 

W

C<sub>5</sub> FIXED THESHOLD

APPROVED	Ò.G.	FIG.
BY	CLASS	SUBCLASS
DRAFTSMAN		

FIG. 20



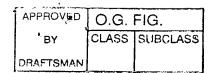
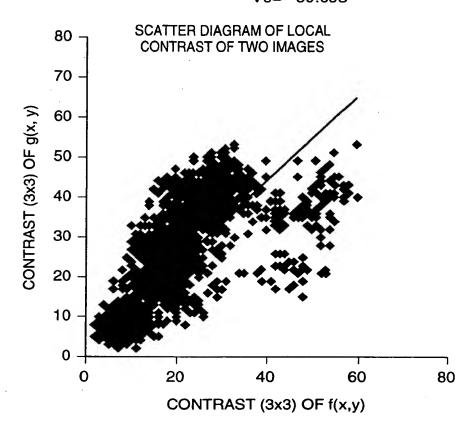


FIG. 21

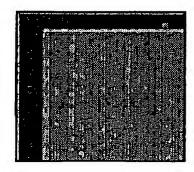
# 1) AFTER ALIGNMENT WITH ACCURACY OF PIXEL UNIT

GRADIENT	INTERCEPT
1.038	2.336

Vr= 125.774 Ve= 59.653



#### **VALUE OF Ve**



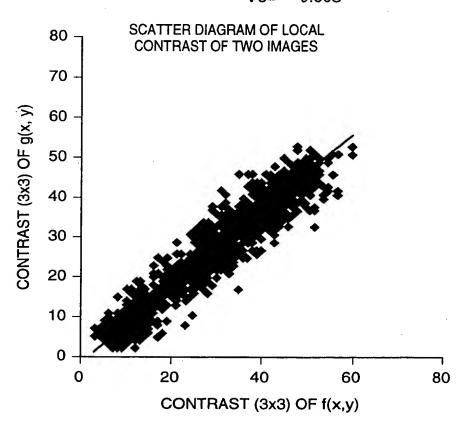
APPROVED	O.G.	FIG.
BY	CLASS	SUBCLASS
DRAFTSMAN		

FIG. 22

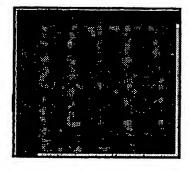
#### 2) AFTER MATCHING OF BRIGHTNESS

GRADIENT	INTERCEPT
0.958	-1.649

Vr= 175.852 Ve= 9.603



#### VALUE OF Ve



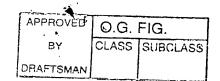


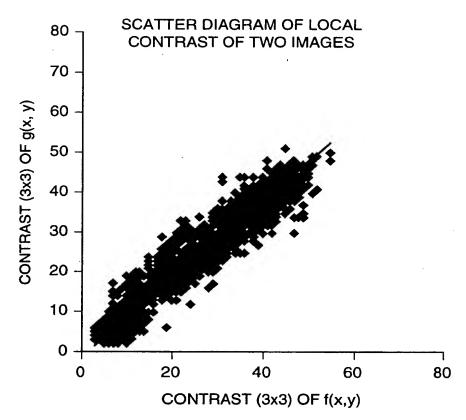
FIG. 23

### 3) AFTER ALIGNMENT OF SUB-PIXEL

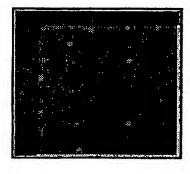
GRADIENT	INTERCEPT
0.981	-1.454

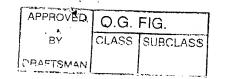
Vr= 168.393

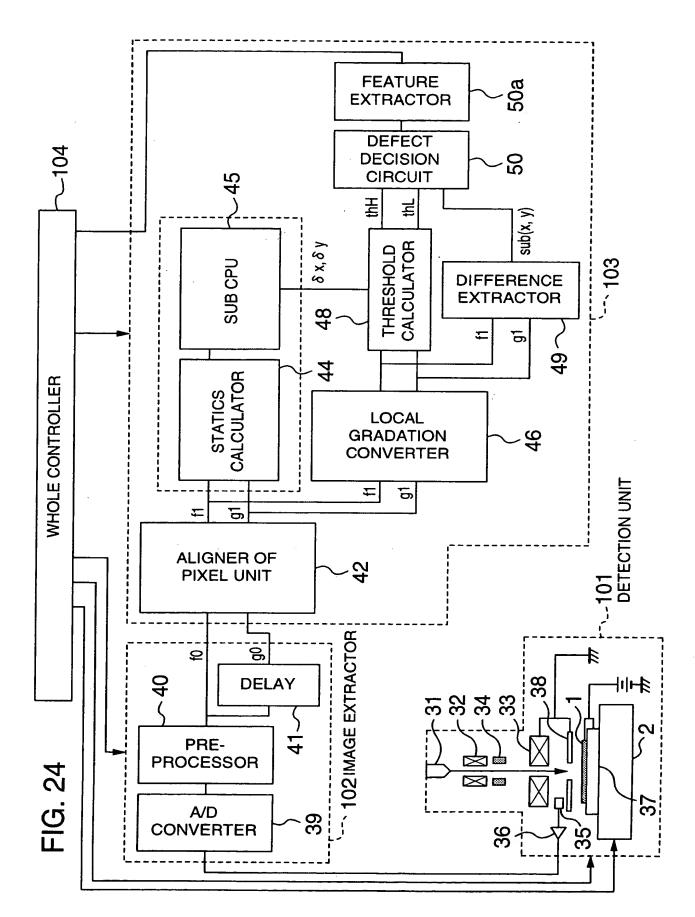
Ve= 8.869



## VALUE OF Ve







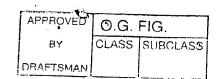


FIG. 25

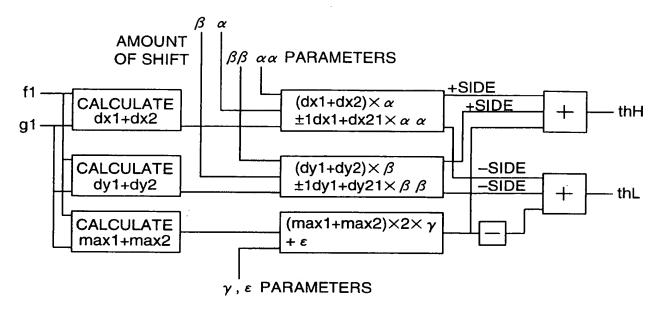
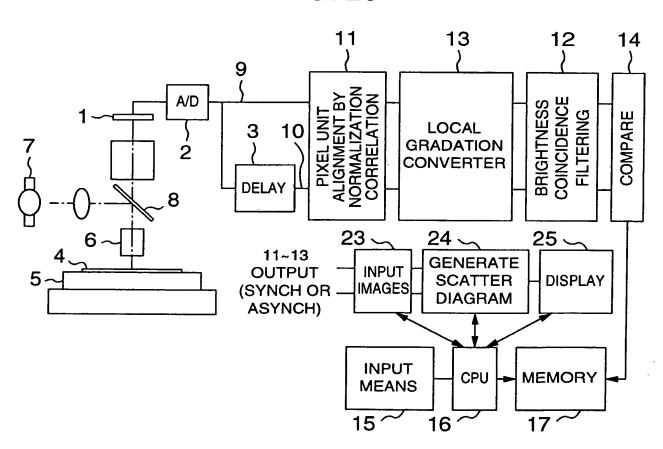
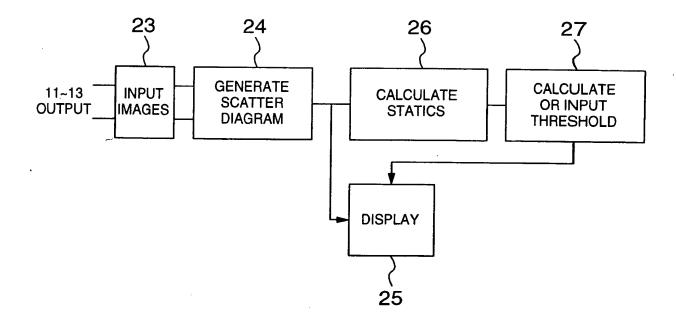


FIG. 26



APPROVED	∗O.G.	FIG.
BY	CLASS	SUBCLASS
DRAFTSMAN		

FIG. 27



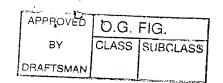
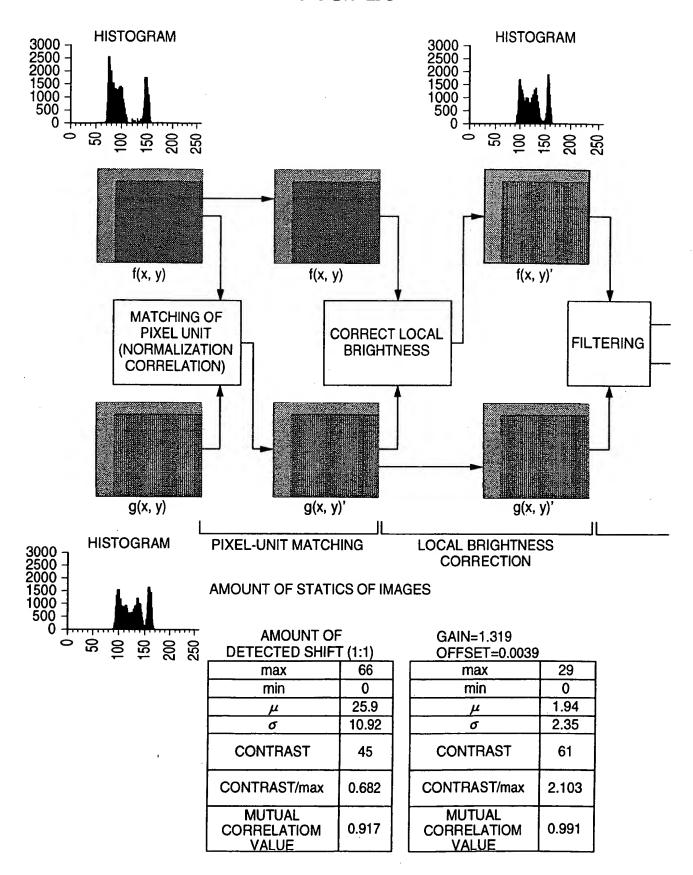


FIG. 28



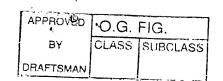
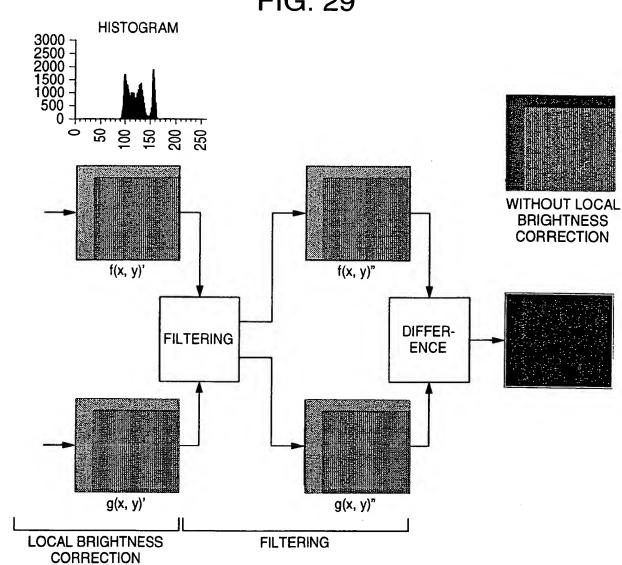


FIG. 29



GAIN=1.319 OFFSET=0.0039

O110E1=0.0000			
max	29		
min	0		
μ	1.94		
σ	2.35		
CONTRAST	61		
CONTRAST/max	2.103		
MUTUAL CORRELATIOM VALUE	0.991		

 $\alpha = 0.036(x)$  $\beta = 0.106(y)$ 

max	25
min	0
μ	1.92
σ	1.87
CONTRAST	57
CONTRAST/max	2.280
MUTUAL CORRELATIOM VALUE	0.993

APPROVED	'O.G.	FIG.
BY	CLASS	SUBCLASS
DRAFTSMAN		

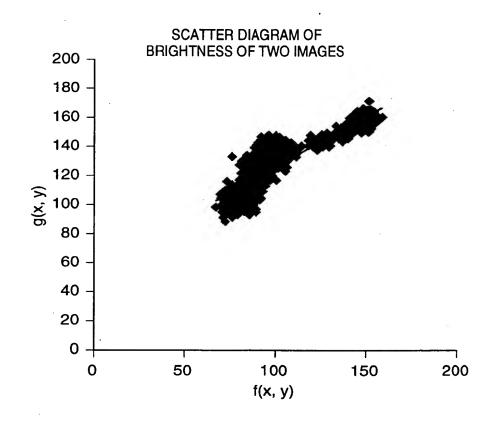
FIG. 30

SCATTER OF BRIGHTNESS OF TWO IMAGES AND AMOUNT OF STATICS Ve

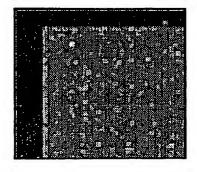
1) AFTER ALIGNMENT OF PIXEL UNIT

GRADIENT	INTERCEPT
0.705	55.947

Vr= 447.4806 Ve= 40.02821



**VALUE OF Ve** 



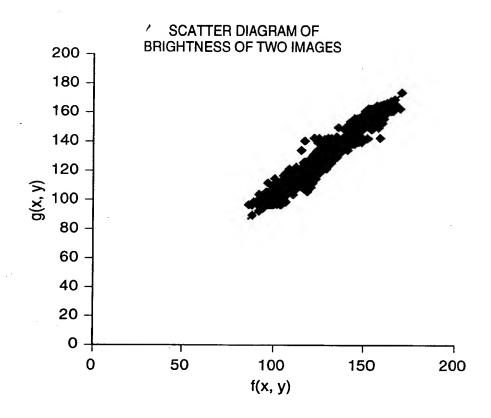
APPROYED	O.G.	FIG.
BY	CLASS	SUBCLASS
DRAFTSMAN	4_2	

FIG. 31

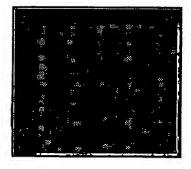
#### 2) AFTER BRIGHTNESS MATCHING

GRADIENT	INTERCEPT	
0.986	2.567	

Vr= 478.921 Ve= 8.598012



**VALUE OF Ve** 



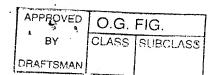
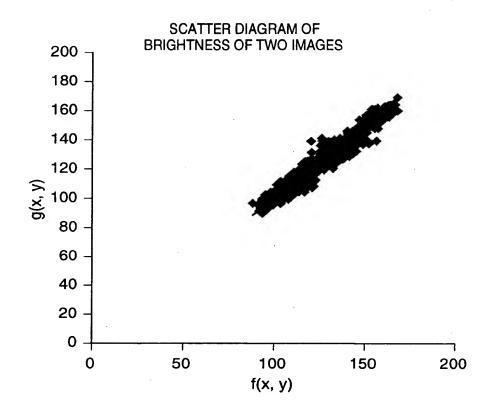


FIG. 32

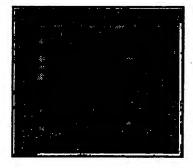
#### 3) AFTER FILTERING

GRADIENT	INTERCEPT
0.991	1.568

Vr= 473.2729 Ve= 7.477604

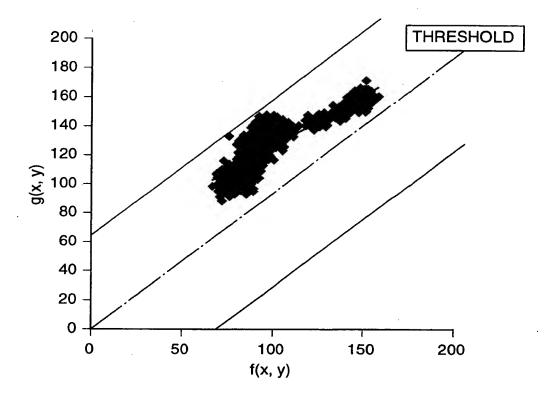


VALUE OF Ve



APPROV D	•O.G.	FIG.
BY	CLASS	SUBCLASS
DRAFTSMAN		

FIG. 33



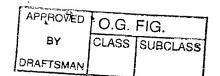
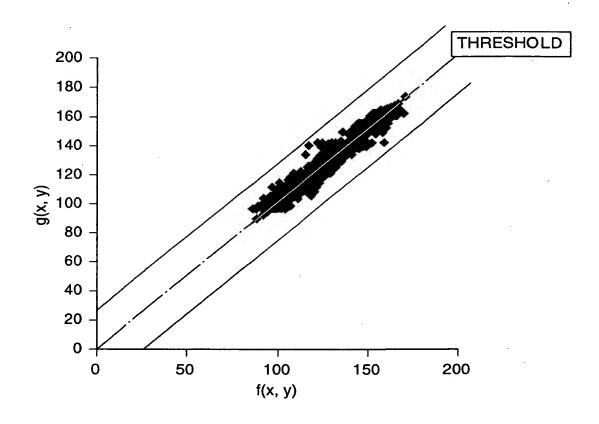
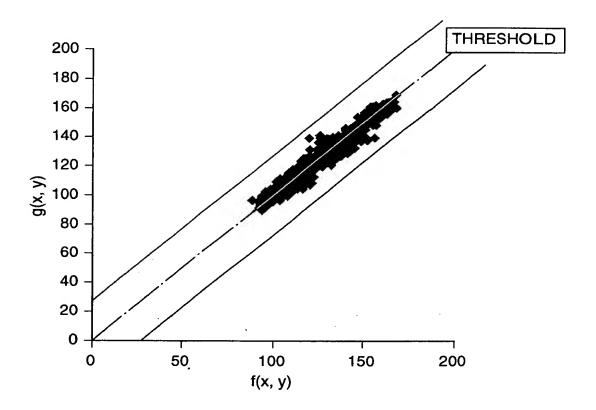


FIG. 34



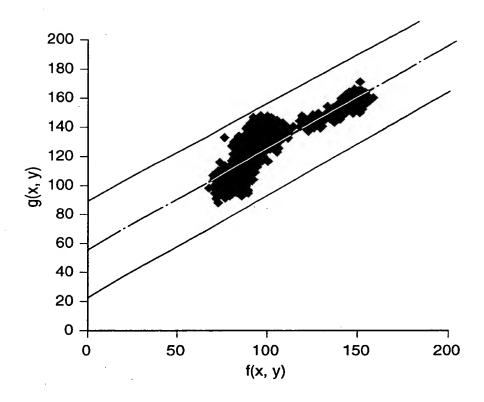
APPROVED	O.G. FIG.		
BY "	CLASS	SUBCLASS	
DRAFTSMAN			

FIG. 35



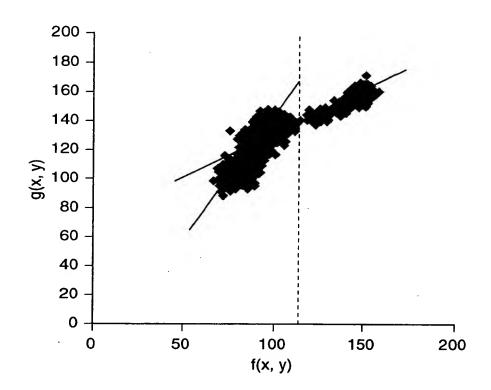
APPRÖVED	O.G.	FIG.
BY	CLASS	SUBCLASS
DRAFTSMAN		

FIG. 36



APPROVED	O.G.	FIG.
BY A	CLASS	SUBCLASS
DRAFTSMAN		

FIG. 37



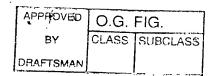


FIG. 38

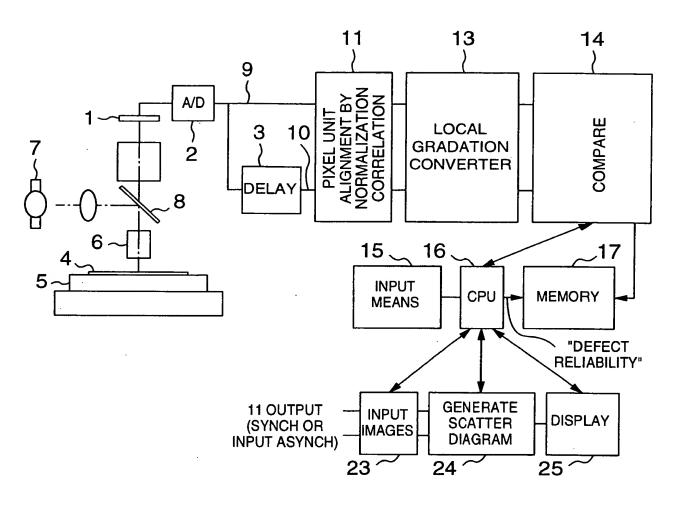
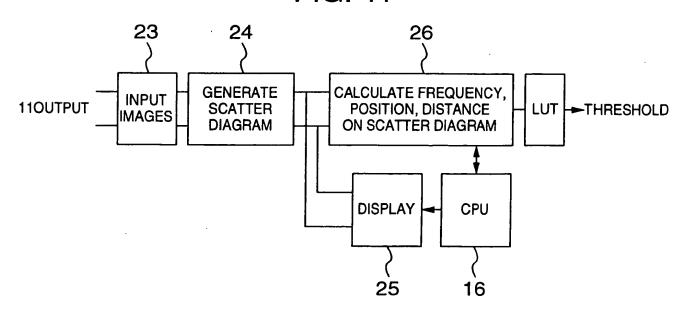


FIG. 41



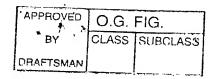
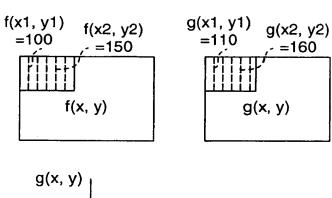
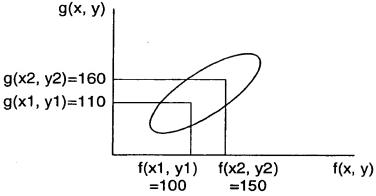
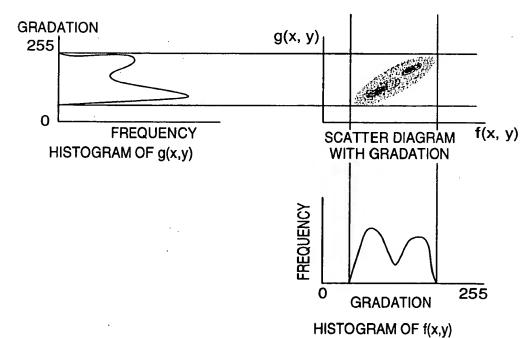


FIG. 39







GRAY;FREQUENCY 0

WHITE:LOW FREQUENCY

BLACK:HIGH FREQUENCY

1

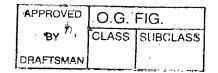
1

1

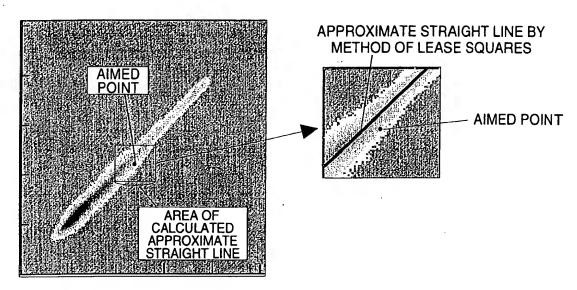
1

1

255
EXAMPLE OF SCATTER DIAGRAM

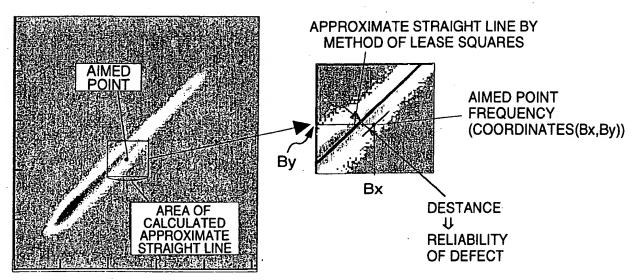


## **FIG. 40A**

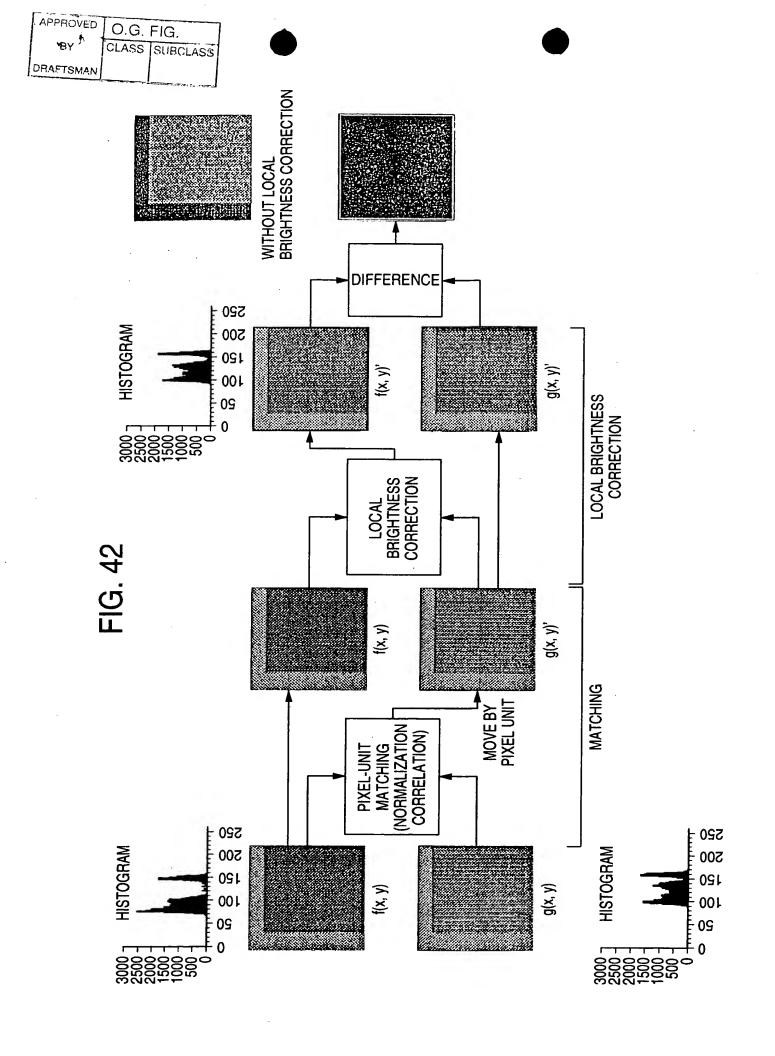


- ESTIMATE STRAIGHT LINE IN AREA WITH CENTER OF AIMED POINT ON SCATTER DIAGRAM, AND SELECT THE GAIN AND OFFSET AS CORRECTION COEFFICIENTS
- MAKE AREA SIZE VARIABLE ACCORDING TO FREQUENCY OF SCATTER DIAGRAM

# FIG. 40B



- ESTIMATE STRAIGHT LINE IN AREA WITH CENTER OF AIMED POINT ON SCATTER DIAGRAM, AND SELECT THE GAIN AND OFFSET AS CORRECTION COEFFICIENTS
- MAKE AREA SIZE VARIABLE ACCORDING TO FREQUENCY OF SCATTER DIAGRAM



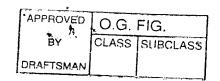


FIG. 43A

1) AFTER ALIGNMENT WITH ACCURACY OF PIXEL UNIT

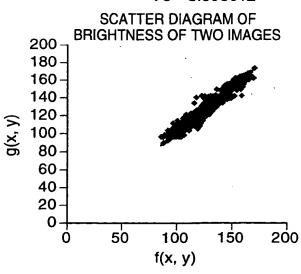
	·_			_
GF	RADIENT	INTER	CEPT	
(	0.705	55.9	947	1
				-
		Ve= 40.	.02821	
	SCATT	FR DIAGE	RAMOF	
000				iES
			•	
160-				
140-				
120-				
100-	1			
	3			
		•		
		100	450	
U	50		150	200
		f(x, y)		
	200 - 180 - 160 - 140 - 120 - 100 - 80 - 60 - 40 - 20 - 0 -	BRIGHTNE  180 - 160 - 140 - 120 - 100 - 80 - 60 - 40 - 20 -	0.705 55.9  Vr= 44  Ve= 40  SCATTER DIAGR BRIGHTNESS OF TV  180- 160- 140- 120- 100- 80- 60- 40- 20- 0	0.705 55.947  Vr= 447.4806 Ve= 40.02821  SCATTER DIAGRAM OF BRIGHTNESS OF TWO IMAGE  180- 160- 140- 120- 100- 80- 60- 40- 20- 0 50 100 150

FIG. 43B

2) AFTER BRIGHTNESS MATCHING

GRADIENT	INTERCEPT				
0.986	2.567				

Vr= 478.921 Ve= 8.598012



DRAFTSM		आप. यः स्थानः		_ ¥8.95 	( <u>)</u>		⊢ KNO. ŠO.	, (00	(00
	DEFECT RELIABILIRY (FREQUENCY INFORMATION)	100	250	DEFECT RELIABILIRY (DISTANCE	INTOCHINA 25	12	DEFECT RELIABILIRY (POSITION INFORMATION)	(100, 200)	(250, 200)
	DEFECT BRIGHTNESS DIFFERENCE	14	20	DEFECT BRIGHTNESS DIFFERENCE	14	20	DEFECT BRIGHTNESS DIFFERENCE	14	20
	DEFECT LENGTH	(2.2, 1.6)	(2.9, 4.2)	DEFECT	(2.2, 1.5)	(2.9, 4.2)	DEFECT	(2.2, 1.5)	(2.9, 4.2)
	DEFECT	4.54	10.2	DEFECT	4.54	10.2	DEFECT	4.54	10.2
	DEFECT COORDINATES	(100.10, 202.20)	(120.75, 232.72)	DEFECT	(100.10, 202.20)	(120.75, 232.72)	DEFECT	(100.10, 202.20)	(120.75, 232.72)
	FIG. 44A DEFECT NUMBER	<del>-</del> ,	0 B	FIG. 44B DEFECT NUMBER	-	a w	FIG. 44C DEFECT NUMBER	-	2

APPROVED O.G. FIG.
CLASS SUBCLASS

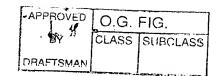


FIG. 45

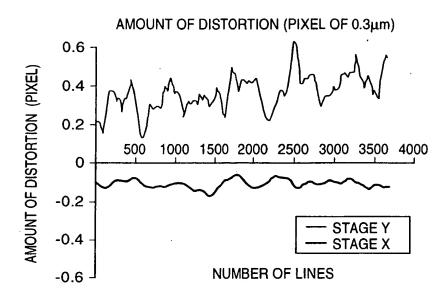


FIG. 46

SPECTRUM ANALYSIS: VARI CASE NUMBER: 126 WEIGHT OF HAMMING: 0357, 2411, 4464, 2411, 0357

